CLAIMS

1. A method of manufacturing a semiconductor device comprising the steps of:

emitting a laser beam which is a fundamental wave from a laser oscillator;

delivering the laser beam onto a semiconductor; and

crystallizing the semiconductor by irradiating with the laser beam which generates multiphoton absorption while moving the surface of the semiconductor relatively to the laser beam.

2. A method of manufacturing a semiconductor device comprising the steps of:

forming an impurity region in a semiconductor;

emitting a laser beam which is a fundamental wave from a laser oscillator;

delivering the laser beam onto the semiconductor; and

activating the impurity region by irradiating with the laser beam which generates multiphoton absorption while moving the surface of the semiconductor relatively to the laser beam.

3. A method of manufacturing a semiconductor device comprising the steps of:

emitting a laser beam which is a fundamental wave from a laser oscillator;

delivering the laser beam onto a semiconductor; and

crystallizing the semiconductor by irradiating with the laser beam which generates multiphoton absorption while moving the surface of the semiconductor relatively to the laser beam,

wherein the laser beam has a peak out power ranging from 1 GW/cm^2 to 1 TW/cm^2.

4. A method of manufacturing a semiconductor device comprising the steps of:

forming an impurity region in a semiconductor;

emitting a laser beam which is a fundamental wave from a laser oscillator;

delivering the laser beam onto the semiconductor; and

activating the impurity region by irradiating with the laser beam which generates multiphoton absorption while moving the surface of the semiconductor relatively to the laser beam,

wherein the laser beam has a peak out power ranging from 1 GW/cm^2 to 1 TW/cm^2.

5. A method of manufacturing a semiconductor device comprising the steps of:

forming a semiconductor layer over a substrate;

forming an insulating layer adjacent to the semiconductor layer;

forming a conductive layer adjacent to the insulating layer;

emitting a laser beam which is a fundamental wave from a laser oscillator;

delivering the laser beam onto the semiconductor layer; and

crystallizing the semiconductor layer by irradiating with the laser beam which generates multiphoton absorption while moving the surface of the semiconductor layer relatively to the laser beam.

6. The method of manufacturing the semiconductor device according to any one of claims 1 to 5,

wherein the laser beam which is a fundamental wave is oscillated with a pulse width of a 1 femtosecond or more and 10 picoseconds or less.

7. The method of manufacturing the semiconductor device according to any one of claims 1 to 5,

wherein the laser beam has a repetition rate of 10MHz or more.

8. The method of manufacturing the semiconductor device according to any one of claims 1 to 5,

wherein the laser beam which is a fundamental wave is emitted from a laser oscillator which includes a crystal selected from the group consisting of Sapphire, YAG, ceramics YAG, ceramicsY_2O_3, KGW, KYW, Mg_2SiO_4, YLF, YVO_4, and $GdVO_4$,

wherein the crystal is added at least one of Nd, Yb, Cr, Ti, Ho, and Er às a dopant.

9. The method of manufacturing the semiconductor device according to any one of claims 1 to 5,

wherein the laser beam has one of a linear shape and an elliptical shape on the irradiation surface.

10. A laser irradiation method comprising the steps of:

emitting a first laser beam which is a fundamental wave from a laser oscillator;

processing the first laser beam into a second laser beam which has one of a linear shape and a rectangular shape on an irradiation surface;

irradiating an object with the second laser beam which generates a multiphoton absorption.

11. The laser irradiation method according to claim 10, wherein the first laser beam has a repetition rate of 10 MHz or higher.

12. The laser irradiation method according to claim 10, wherein the first laser beam which is a fundamental wave is oscillated with a pulse width of a 1 femtosecond or more and 10 picoseconds or less.

13. The laser irradiation method according to claim 10,

wherein the first laser beam is a laser beam emitted from a laser oscillator which includes a crystal selected from the group consisting of Sapphire, YAG, ceramics YAG, ceramicsY_2O_3, KGW, KYW, Mg_2SiO_4, YLF, YVO_4, and $GdVO_4$,

wherein the crystal is added at least one of Nd, Yb, Cr, Ti, Ho, and Er as a dopant.

14. A laser irradiation apparatus comprising:

a solid state laser oscillator for emitting a laser beam which is a fundamental

wave;

a mechanism for projecting and delivering the laser beam which is the fundamental wave onto an irradiation surface, said mechanism including a condenser lens; and

means for moving the irradiation surface relatively to the laser beam which is the fundamental wave,

wherein the condenser lens forms the laser beam which is the fundamental wave into one of a linear shape and an elliptical shape .

15. The laser irradiation apparatus according to claim 15, wherein the condenser lens includes two pieces of convex cylindrical lenses.

16. The laser irradiation method according to claim 15, wherein the laser beam has a repetition rate of 10 MHz or higher.

17. The laser irradiation apparatus according to claim 15, wherein the laser beam emitted from the laser oscillator is oscillated with a pulse width of 1 femtosecond or more and 10 picoseconds or less.

18. The laser irradiation apparatus according to claim 15, wherein the laser beam oscillated from the laser oscillator is emitted from a laser oscillator which includes a crystal selected from the group consisting of Sapphire, YAG, ceramics YAG, ceramicsY_2O_3, KGW, KYW, Mg_2SiO_4, YLF, YVO_4, and $GdVO_4$ added at least one of Nd, Yb, Cr, Ti, Ho, and Er as a dopant.

19. The laser irradiation apparatus according to claim 15, wherein the laser beam has a peak out power ranging from 1 GW/cm^2 to 1 TW/cm^2.